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(12) UK Patent Application (19) GB (11) 2 370 574 (13) A

(43) Date of A Publication 03.07.2002

(21) Application No 0125845.8

(22) Date of Filing 29.10.2001

(30) Priority Data

(31) 0026314 (32) 27.10.2000 (33) GB

(71) Applicant(s)

Faversham Industries Limited
(Incorporated in the British Virgin Islands)
Atlantic Chambers, Romasco Harbour House,
Road Town, Tortola, British Virgin Islands

(72) Inventor(s)

Donald Daisley

(74) Agent and/or Address for Service

Graham Hulse
Hulsemarque, 66 Peveril Road, Endcliffe, SHEFFIELD,
S11 7AR, United Kingdom

(51) INT CL⁷

C09K 3/12 , B29C 73/02 73/16

(52) UK CL (Edition T)

C3N NX N1K
U1S S1383 S1845

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(58) Field of Search

UK CL (Edition T) C3N
INT CL⁷ B29C 73/02 73/16 , C09K 3/12
Online: WPI, EPODOC, PAJ

(54) Abstract Title

Tyre puncture sealant and method of manufacture

(57) A method of manufacture of a tyre puncture sealant contains the following steps: A) Add to a primary vessel the ingredients:

- (i) 1200 litres of water
- (ii) 280 kg of urea
- (iii) 17.5 kg of sodium nitrite
- (iv) 2 kg of an anti-foam emulsion;

B) Stir thoroughly until (ii), (iii) and (iv) are completely dissolved in the water; C) Add to the primary vessel:

- (v) 0.450 kg of BENTONITE
- (vi) 100 kg of calcium carbonate
- (vii) 150 kg of rubber crumb
- (viii) 0.5 kg of FLUOROSCEIN
- (ix) 15 kg of a preservative
- (x) 46 litres of polyvinyl alcohol (PVA);

D) Stir into primary vessel until thoroughly mixed; E) Add the following to a secondary vessel;

- (xi) 484 kg of glycol alcohol
- (xii) 4.10 kg of hydroxyethyl cellulose
- (xiii) 9.20 kg of xanthan gum;

F. Mix (xi), (xii) and (xiii) and add this mixture to primary vessel; and G. Agitate contents of primary vessel for 30 minutes.

A sealant composition is also claimed per se.

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TYRE PUNCTURE SEALANTS

BACKGROUND OF THE INVENTION

This invention relates to tyre puncture sealants, particularly but not exclusively for sealants for repairing punctures in pneumatic tyres for vehicles. The sealant of the present invention may also be used as described, or in modified form, to seal around the rim of a wheel

Various tyre sealants have been proposed and it is one object of the present invention to provide an improved tyre sealant having an enhanced and reliable performance in use.

SUMMARY OF THE INVENTION

According to one aspect of the present invention a method of manufacture of a tyre puncture sealant comprises the following steps:

1. Add to a primary vessel the ingredients:

- A) 1200 litres of water
- B) 280 kg of urea
- C) 17.5 kg of sodium nitrite
- D) 2 kg of an anti foam emulsion

2. Stir thoroughly until B), C) and D) are completely dissolved in the water;

3. Add to the primary vessel:

- E) 0.450 kg of BENTONITE
- F) 100 kg of calcium carbonate
- G) 150kg of rubber crumb
- H) 0.5 kg of FLUOROSCEIN
- J) 15 kg of a preservative
- K) 446 litres of polyvinyl alcohol (PVA)

4. Stir into primary vessel until thoroughly mixed;

5. Add the following to a secondary vessel;

- L) 484 kg of glycol alcohol
- M) 4.10 kg of a hydroxyethyl cellulose
- N) 9.20 kg of xanthan gum;

6. Mix L), M) and N) and add this mixture to primary vessel;
and

7. Agitate contents of primary vessel for 30 minutes.

In practise the above method produces 2500 litres of sealant of which, for example, between 250 ml and 1 litre may be used to seal punctures in a variety of typical tyre sizes.

The primary vessel is usually provided by a large agitation vessel having mixing blades or the like.

The Urea which is preferably a powder, commonly a concentrate fertiliser such as carbamide or carbamide resin.

Preferably the anti-foam emulsion is a silicone anti-foam emulsion such as polydimethylsiloxane.

In a preferred form the Bentonite is a mixture containing SiO_2 , Al_2O_3 , Fe_2O_3 and the oxides of Calcium, Magnesium, Potassium and Sodium.

The rubber crumb is preferably of a mixed particle size to encourage tighter bonding, the various particle sizes pack together with fewer gaps. In one embodiment 75g of the rubber crumb is of an average particle size of between 0.25mm and 1.70mm, the remaining 75g being of an average particle size of between 0.15mm and 1.00mm.

Any suitable preservative may be used such as Biocide R10, a soluble substance based on a combination of hemiacetals.

In one embodiment the glycol alcohol is a nonethylene glycol, also known as 1,2-Ethenediol.

According to another aspect of the present invention a tyre puncture sealant comprises the following:

- A) 1200 litres of water
- B) 280 kg of urea
- C) 17.5 kg of sodium nitrite
- D) 2 kg of an anti foam emulsion
- E) 0.450 kg of BENTONITE
- F) 100 kg of calcium carbonate
- G) 150kg of rubber crumb
- H) 0.5 kg of FLUOROSCEIN

- J) 15 kg of a preservative
- K) 446 litres of polyvinyl alcohol (PVA)
- L) 484 kg of glycol alcohol
- M) 4.10 kg of a hydroxyethyl cellulose, and
- N) 9.20 kg of xanthan gum;

According to a further aspect of the present invention a tyre puncture sealant comprises the following:

- A) 1200 litres of water;
- B) 280 kg of UREA-PRILLS U-TEC;
- C) 17.5 kg of sodium nitrite;
- D) 2 kg of ANTI-F SEA 30%;
- E) 0.450 kg of BENTONITE;
- F) 100 kg of DURCAL 15;
- G) 75 kg of RUBBER 20#;
- H) 75 kg of RUBBER 12#
- I) 0.5 kg of FLUOROSCEIN;
- J) 15 kg of BIOCID R10;
- K) 446 litres of PVA 10%;
- L) 484 kg of MONO ETHY GLY;
- M) 4.10 kg of TYLOSE H6000YP2; and
- N) 9.20 kg of KELZAN.

A number of tests have been conducted using the sealant, representative examples are given below.

EXAMPLE 1

In stable conditions at a temperature of 23° a tubeless radial tyre, in this case a UNIROYAL MAX 400, size - 215/70R 15C 109/107P was injected with 1 litre of sealant and punctured using a spike having a diameter of 6 mm. Upon removal of the spike resealing of the tyre was achieved by repeated bouncing of the tyre on a surface, in this case a hard floor. Subsequently the tyre was subjected to progressive increases in gas pressure, using an oxygen free gas, in this case N₂ in 10psi increments up to 160psi and held at that pressure for 2 minutes. The gas pressure was reduced and a further five punctures induced in the tread surface with the same spike as before. Resealing was once again induced by repeated bouncing of the tyre. A second stepped pressure increase was conducted in the same increments as before again to 160psi and held at that pressure for 2 minutes.

It was found that the tyre with six 6 mm punctures withstood the pressure applied and showed no leakage or pressure loss during both periods of increased pressure.

The same tyre was subsequently subjected to some 40 separate punctures using a variety of differently sized nails and spikes applied at random about the tyre's circumference as well as re-penetrating the six punctures from the first part of the test. The tyre was pressurised to a nominal level and the sealant applied by bouncing the tyre. Further pressurisation of the tyre to 45psi was applied and the tyre left isolated for a period of 10 days during which periodic test were conducted for pressure loss. The tyre showed no evidence of leakage or pressure loss.

EXAMPLE 2

In the second example a good quality 185/60R 14 (82H) tyre was mounted on a suitable rim and injected with 250 ml of sealant. The tyre was then inflated to 41 psi and conditioned in a test area at a temperature between 20° to 30° C. In six locations across the crown are of one position on the tyre a 6 mm diameter spike was hammer driven into and removed from the tyre, the tyre was then rotated to allow the sealant to seal the penetrations and the try re-pressurised to 41 psi.

The tyre was then tested at a speed of 70 mph for a simulated distance of 25,000 miles with a load of 380 kg applied during the test. Tyre pressures measured immediately after the test and after a cooling period of 24 hours showed that the sealant had effectively sealed the punctures.

CLAIMS

1. A method of manufacture of a tyre puncture sealant comprising the following steps:

A) Add to a primary vessel the ingredients:

- (i) 1200 litres of water
- (ii) 280 kg of urea
- (iii) 17.5 kg of sodium nitrite
- (iv) 2 kg of an anti-foam emulsion;

B) Stir thoroughly until (ii), (iii) and (iv) are completely dissolved in the water;

C) Add to the primary vessel:

- (v) 0.450 kg of BENTONITE
- (vi) 100 kg of calcium carbonate
- (vii) 150 kg of rubber crumb
- (viii) 0.5 kg of FLUOROSCEIN
- (ix) 15 kg of a preservative
- (x) 446 litres of polyvinyl alcohol (PVA)

D) Stir into primary vessel until thoroughly mixed;

E) Add the following to a secondary vessel;

- (xi) 484 kg of glycol alcohol
- (xii) 4.10 kg of hydroxyethyl cellulose
- (xiii) 9.20 kg of xanthan gum;

F. Mix (xi), (xii) and (xiii) and add this mixture to primary vessel; and

G. Agitate contents of primary vessel for 30 minutes.

2. A method of manufacture of a tyre puncture sealant as in Claim 1 characterised in that the primary vessel is a large agitation vessel having mixing blades.

3. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the urea is a powder containing carbamide.

4. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the anti-foam emulsion is a silicone anti-foam emulsion.

5. A method of manufacture of a tyre puncture sealant as in Claim 4 characterised in that the silicone anti-foam emulsion is polydimethylsiloxine.

6. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the ingredient known as Bentonite is a mixture containing SiO₂, Al₂O₃, Fe₂O₃ and the oxides of Calcium, Magnesium, Potassium and Sodium.

7. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the rubber crumb is of a mixed particle size.

8. A method of manufacture of a tyre puncture sealant as in Claim 7 characterised in that 75g of the rubber crumb is of an average particle size of between 0.25mm and 1.70mm, the remaining 75g being of an average particle size of between 0.15mm and 1.00mm.

9. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the preservative is a soluble substance based on a combination of hemiacetals.

10. A method of manufacture of a tyre puncture sealant as in any preceding Claim characterised in that the glycol alcohol is a nonethylene glycol.

11. A tyre puncture sealant comprising the following:

- (i) 1200 litres of water
- (ii) 280 kg of urea
- (iii) 17.5 kg of sodium nitrite
- (iv) 2 kg of an anti foam emulsion
- (v) 0.450 kg of BENTONITE
- (vi) 100 kg of calcium carbonate
- (vii) 150kg of rubber crumb
- (viii) 0.5 kg of FLUOROSCEIN
- (ix) 15 kg of a preservative
- (x) 446 litres of polyvinyl alcohol (PVA)
- (xi) 484 kg of glycol alcohol
- (xii) 4.10 kg of a hydroxyethyl cellulose, and
- (xiii) 9.20 kg of xanthan gum.

12. A tyre puncture sealant as in any preceding Claim 11 characterised in that the urea is a powder containing carbamide.

13. A tyre puncture sealant as in either Claim 11 or Claim 12 characterised in that the anti-foam emulsion is a silicone anti-foam emulsion.

14. A tyre puncture sealant as in any one of Claims 11 to 13 characterised in that the silicone anti-foam emulsion is polydimethylsiloxine.

15. A tyre puncture sealant as in any one of Claims 11 to 14 characterised in that the ingredient known as Bentonite is a mixture containing SiO₂, Al₂O₃, Fe₂O₃ and the oxides of Calcium, Magnesium, Potassium and Sodium.

16. A tyre puncture sealant as in any one of Claims 11 to 15 characterised in that the rubber crumb is of a mixed particle size.

17. A tyre puncture sealant as in Claim 16 characterised in that 75g of the rubber crumb is of an average particle size of between 0.25mm and 1.70mm, the remaining 75g being of an average particle size of between 0.15mm and 1.00mm.

18. A tyre puncture sealant as in any one of Claims 11 to 17 characterised in that the preservative is a soluble substance based on a combination of hemiacetals.

19. A tyre puncture sealant as in any one of Claims 11 to 18 characterised in that the glycol alcohol is a nonethylene glycol.

20. A tyre puncture sealant as in Claim 11 characterised in that the ingredients are as following:

- A) 1200 litres of water;
- B) 280 kg of UREA-PRILLS U-TEC;
- C) 17.5 kg of sodium nitrite;

- D) 2 kg of ANTI-F SEA 30%;
- E) 0.450 kg of BENTONITE;
- F) 100 kg of DURCAL 15;
- G) 75 kg of RUBBER 20#;
- H) 75 kg of RUBBER 12#
- I) 0.5 kg of FLUOROSCEIN;
- J) 15 kg of BIOCID R10;
- K) 446 litres of PVA 10%;
- L) 484 kg of MONO ETHY GLY;
- M) 4.10 kg of TYLOSE H6000YP2; and
- N) 9.20 kg of KELZAN.

21. A tyre sealed by a sealant made in accordance with the methods of any one of Claims 1 to 10.

22. A tyre sealed by a sealant as in any one of Claims 11 to 20

23. A method of manufacture of a tyre puncture sealant as hereinbefore described.

24. A tyre puncture sealant as hereinbefore described.



INVESTOR IN PEOPLE

Application No: GB 0125845.8
Claims searched: 1 to 24

Examiner: Matthew Clarke
Date of search: 22 April 2002

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): C3N

Int Cl (Ed.7): B29C (73/02, 73/16) C09K (3/12)

Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

| Category | Identity of document and relevant passage | Relevant to claims |
|----------|--|--------------------|
| A | US 6013697 A (TRUE et al) see whole document, especially Table 1 | |
| A | US 5364463 A (HULL) see whole document | |
| A | WPI Abstract Accession No.1999-338325 [29] & CN 1210128 A (YUE YUDONG) | |
| A | WPI Abstract Accession No.1994-016737 [03] & CN 1069929 A (JINTAO CAI) | |

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